

Landfill Gas Mitigation System Design for Post-Closure Building Development

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Regulatory Framework for Post-Closure Development

- ⌚ CCR Title 27 California Integrated Waste Management Board
Postclosure Land Use regulations (§ 21190).
- ⌚ Plans and specifications are reviewed and approved by the
Enforcement Agency (EA, formerly LEA) and California Regional
Water Quality Control Board.
- ⌚ Local air district (e.g., BAAQMD, SCAQMD, SJVAPCD) may
require “Permit to Construct” and “Permit to Operate”, depending
upon presence and concentrations of specific VOCs; methane may
be exempt, depending upon district.

Regulatory Requirements

All on-site construction on top of landfills or within 1,000 feet of the boundary of any disposal area must meet the following criteria:

- 1) Geomembrane or equivalent... between floor slab... and subgrade;
- 2) Permeable layer of open graded material... with a minimum thickness of 12 inches... between the geomembrane and subgrade ...;
- 3) Geotextile filter... to prevent the introduction of fines into the permeable layer;
- 4) Perforated venting pipes shall be installed within the permeable layer....;

Regulatory Requirements (cont.)

- 5) The venting pipe shall be constructed with the ability to be connected to an induced draft exhaust system;
- 6) Automatic methane gas sensors shall be installed within the permeable gas layer, and inside the building...; and
- 7) Periodic methane gas monitoring shall be conducted inside all buildings and underground utilities...

T&R's experience has been that regulators may be willing to negotiate certain technical details of mitigation systems, provided the design principles are sound and the regulatory intent is met.

Achieving Regulatory Compliance

- ⌚ Landfill gas collection, venting and monitoring system designed and installed for each building.
- ⌚ Collection system consists of horizontal perforated pipes in a grid pattern under the building slab that vent to atmosphere above the roof level.
- ⌚ Passive vent system connected to wind turbine at roof.
- ⌚ Active vent system connected to vacuum blower at roof.

Achieving Compliance (cont.)

- ⌚ Gas impermeable membrane typically installed beneath building slab to prevent methane migration into building.
 - Some designs have membrane on top of building slab, covered with a topping slab.
- ⌚ Monitoring system includes methane sensors mounted on first floor ceiling, adjacent to return air intakes, tops of stairways, and elevator shafts at roof level.
- ⌚ Sensors wired to control panel with alarm systems and automatic starter to active vent system.
- ⌚ “Plugs” in utility trenches leading underneath building.

Sierra Point, South San Francisco



Venting System Schematic

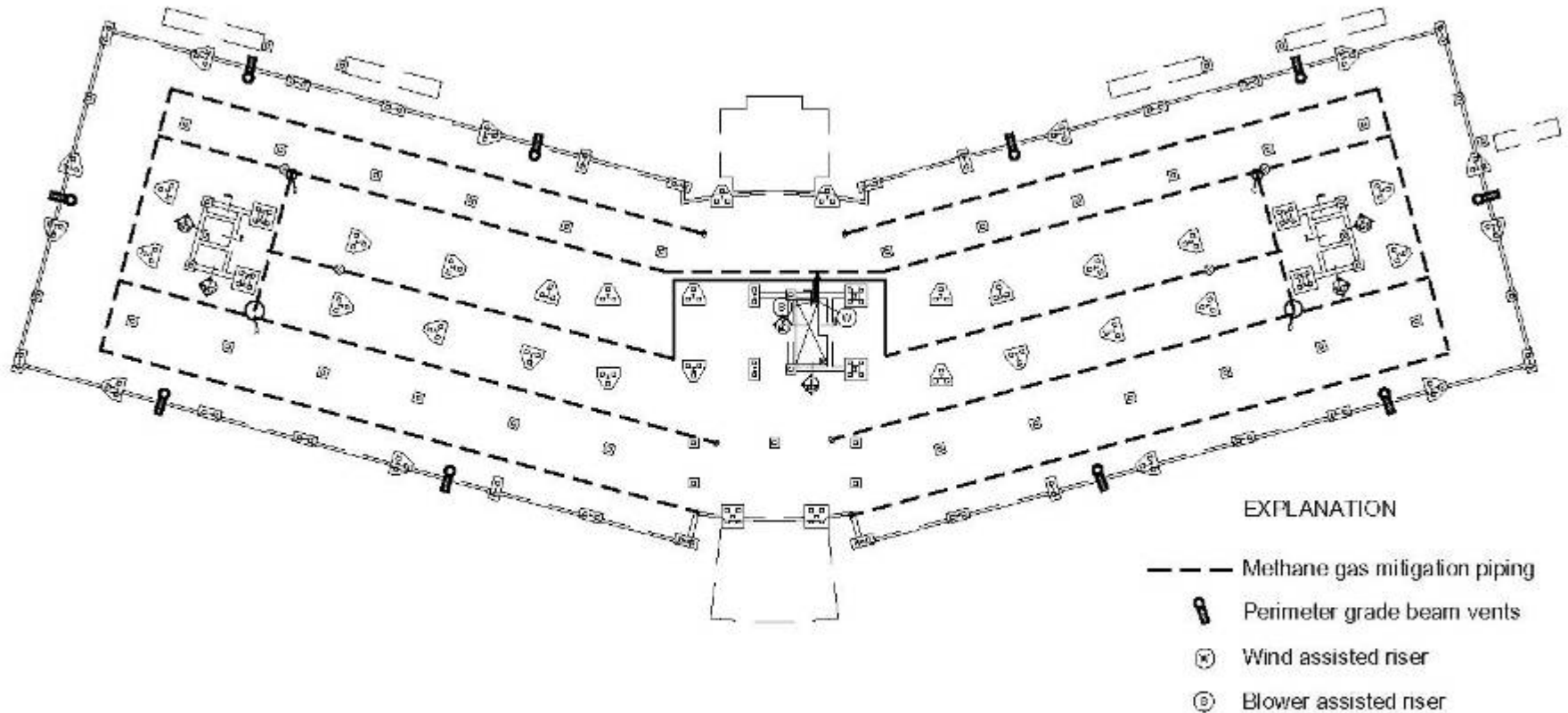
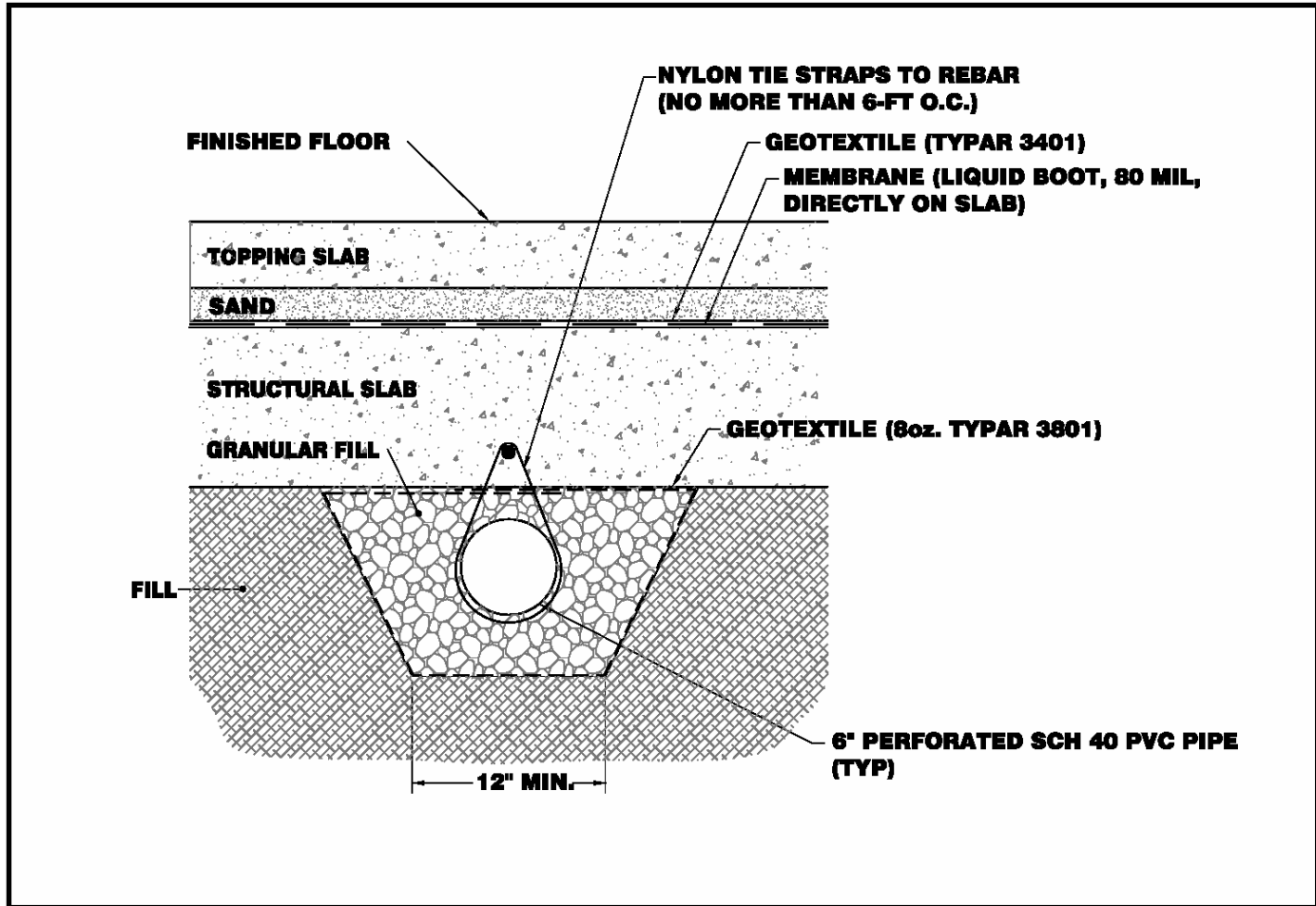


Figure 1

Venting System Detail



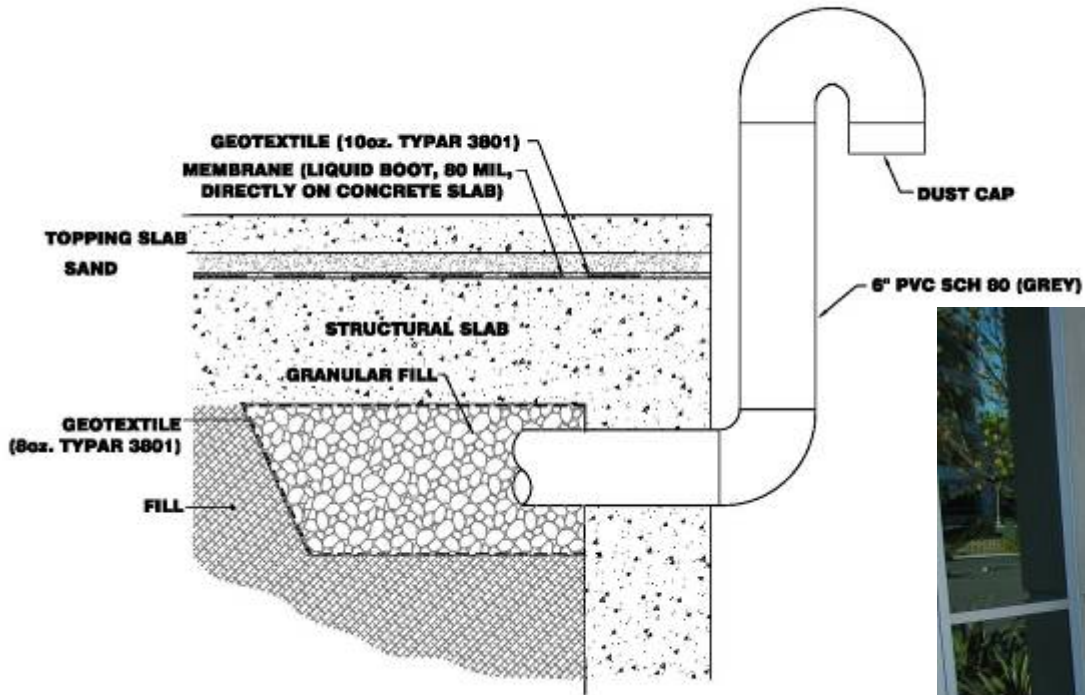
Venting System Collection Pipe Layout



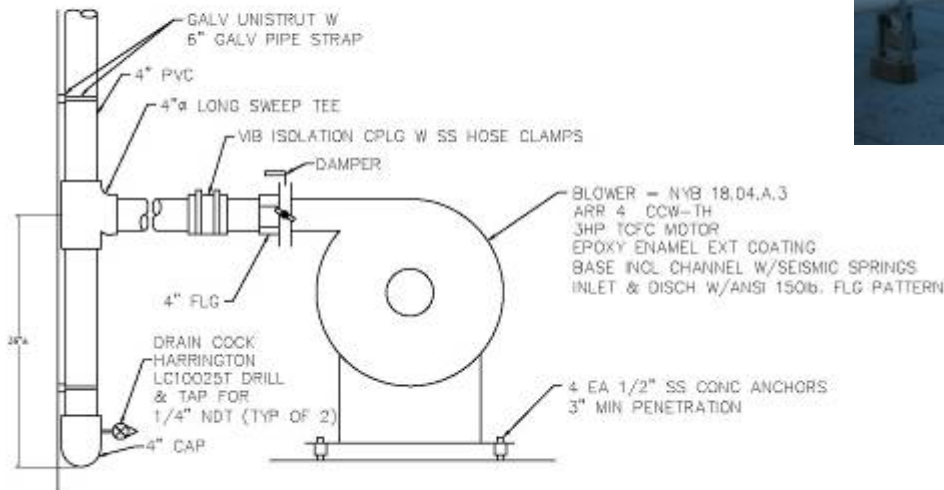
Liquid Boot™ Membrane Application



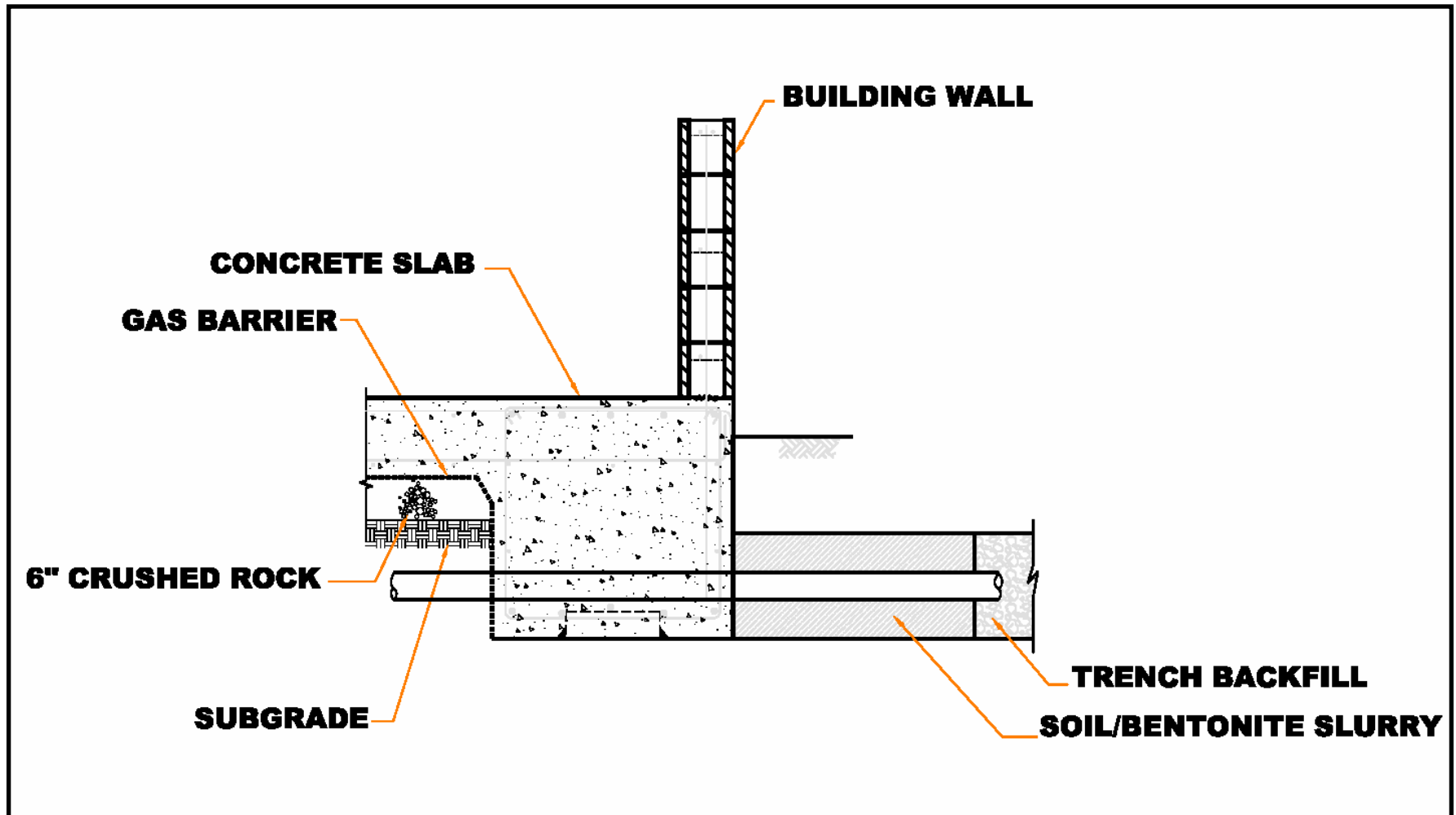
Perimeter Grade Beam Vents



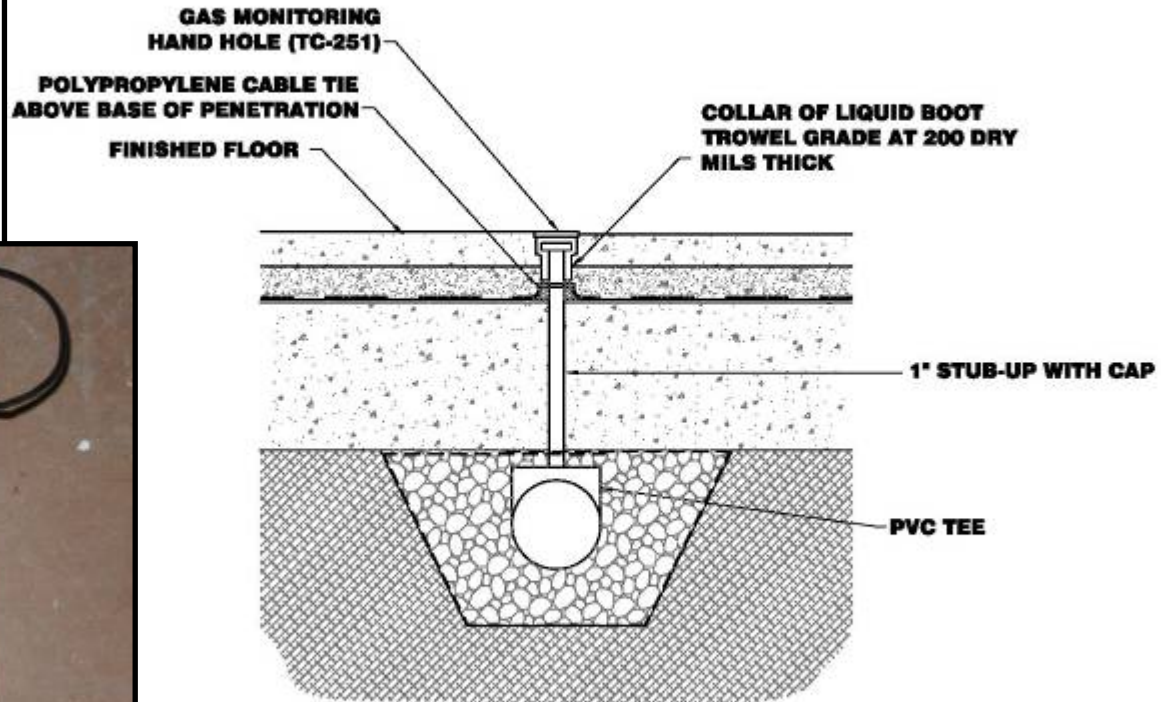
Wind and Power Turbines at Roof Level



Typical Utility Trench Soil Gas Cut-off at Perimeter of Building



Sub-Slab Monitoring Test Port



Sub-slab Monitoring Test Port



Methane Sensors (Indoor Air)

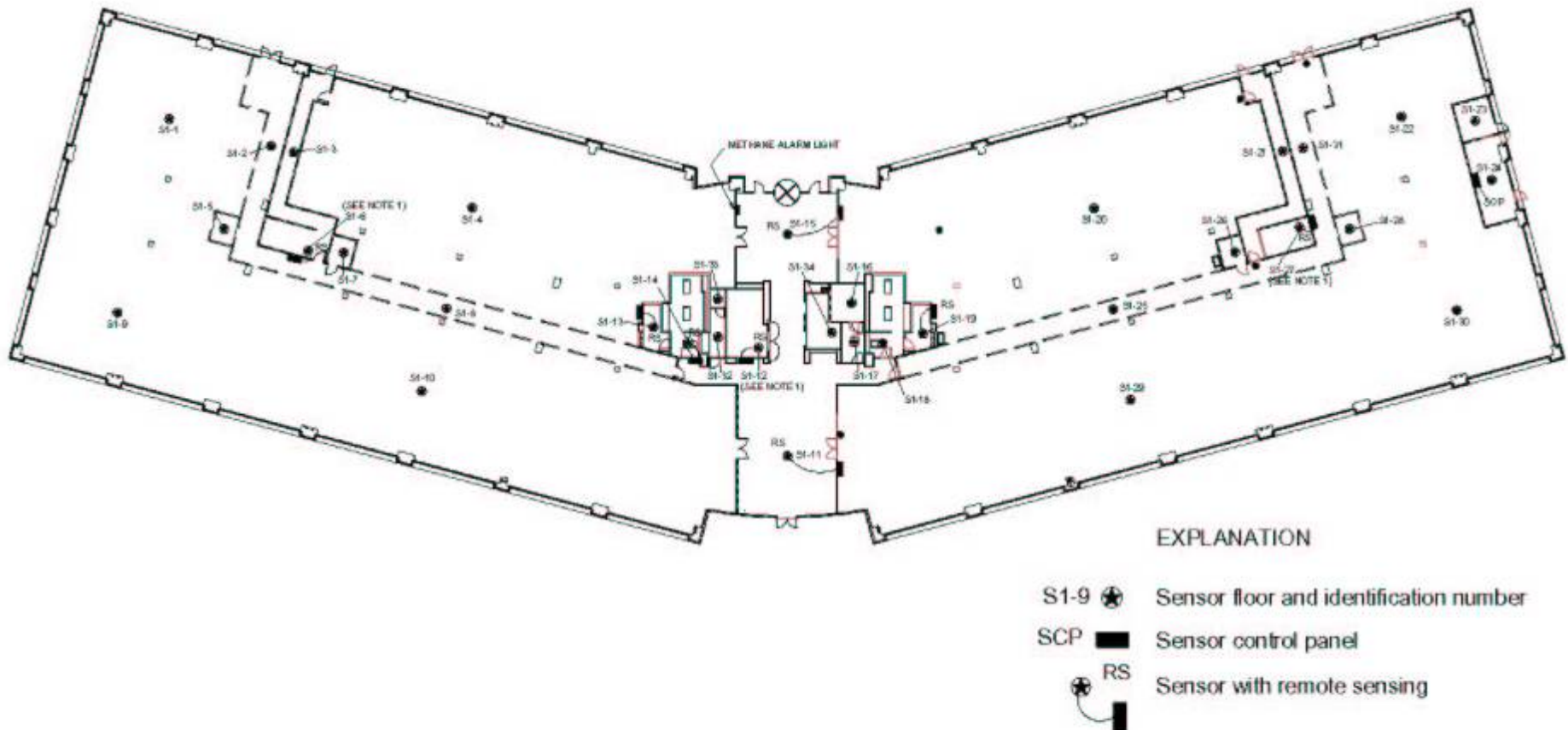


Figure 6

Methane Sensors

Ceilings of interior spaces
(shown prior to TIs)



At top of stairwell
(leading to roof)

Audible and Visible Alarms



Control systems panels
with backup power supply

Alarms in front lobby

- 20% LEL – Building fire protection system company alerted; building management personnel called; warning light in lobby illuminated; blower-assisted venting system activated.
- 25% LEL – Building HVAC is switched to “smoke removal function” (OSHA limit for methane = 1.25%).
- 40% LEL – Horn alarm activated; Fire Dept. called.



Vapor Intrusion Mitigation System: Summary

- Mitigation system allows facility development on top of a closed landfill that will continue to generate methane for many years (decades).
- Wind-Assist System integral to building construction.
 - Effective in reducing sub-slab vapor concentrations.
 - Low-maintenance with minimal O&M costs.
 - Power-Assist System will operate only if/when needed.
- Sensors and alarms integrated into life safety systems.
- Ability to verify system performance by direct air flow monitoring of sub-slab piping system.
 - Higher air flow reduces sub-slab methane concentrations, thereby reducing risk/probability of indoor air exceedances.



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